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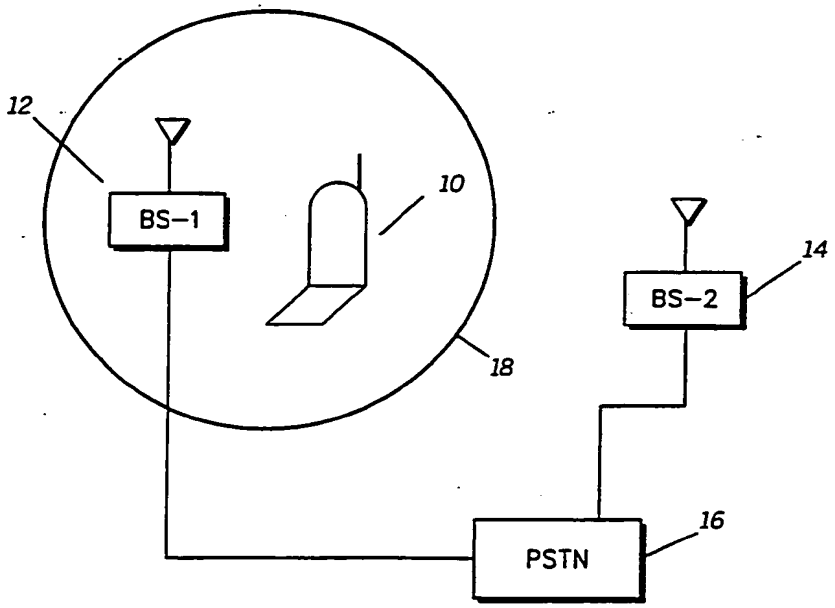
(54) Title: METHOD AND APPARATUS FOR ESTABLISHING A COMMUNICATION LINK



(57) Abstract

A method and apparatus whereby a communication unit (10) transmits a first communication channel request signal at a first power level. If a communication link with a base site (12) is not established within a predetermined period, the communication unit transmits a second communication channel request signal at a second level which is higher than the level of the first communication channel request signal. This process may be continued for a predetermined number of times or until a communication link is established. Thus, the probability that a nearby base site, rather than a more distant site, grants the communication channel is greatly enhanced.

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METHOD AND APPARATUS FOR ESTABLISHING A COMMUNICATION LINK

Technical Field

This invention relates generally to communication systems and more specifically to radio telephone communication systems.

Background

Radio telephone communication systems (such as second generation cordless telephone, or Digital European Cordless Telephone) comprise a plurality of base sites (also known as telepoints) and a plurality of radio telephones (also known as handsets). Taking second generation cordless telephone (CT2) as an example, the users of the CT2 radio telephones communicate with users of other radio telephones or subscribers in a public switched telephone network (PSTN) via the base sites. A large number of base sites is desirable in certain areas (such as shopping malls) where many persons are likely to place radio telephone calls because that eliminates gaps in coverage by the base site network. However, these base sites are not synchronized with each other. When a radio telephone user wishes to place a call, he or she causes the radio telephone unit to transmit a channel request signal. Since each base site is monitoring the channels of the CT2 system independently, the base site that grants the channel request is not necessarily the

one closest to the radio telephone unit transmitting the channel request signal. That may be a problem because the user may move out of range of the base site, thus causing the communication link to be dropped. On the other hand, if the nearest base sites had made the channel grant, the radio telephone user would have been able to continue the communication while moving within a greater area. Accordingly, a need exists for a method and apparatus for acquiring a communication channel that overcomes the above problem.

Summary of the Invention

Briefly, according to the invention, a method and apparatus are provided whereby a communication unit transmits a first communication channel request signal at a first power level. If a communication link with a base site is not established within a predetermined period, the communication unit transmits a second communication channel request signal at a second level which is higher than the level of the first communication channel request signal. This process may be continued for a predetermined number of times or until a communication link is established. Thus, the probability that a nearby base site, rather than a more distant base site, grants the communication channel is greatly enhanced.

Brief Description of the Drawings

FIG. 1 is a simplified block diagram of a communication system in accordance with the invention.

FIG. 2 is a simplified block diagram of a base site in accordance with the invention.

FIG. 3 is a flow chart of a channel acquisition method in accordance with the invention.

FIG. 4 is a flow chart of another channel acquisition method in accordance with the invention.

Detailed Description of the Preferred Embodiment

Referring to FIG. 1, there is shown a simplified block diagram of a communication system in accordance with the invention. A communication unit 10 (preferably, a radio telephone handset) operates in a CT2 communication system that comprises at least first and second base sites, 12 and 14, respectively. The system may also comprise several other base sites, communication units, and a public switched telephone network (PSTN) 16. The communication unit 10 is closer to the first base site 12 than to the second base site 14. When the user of the communication unit 10 wishes to make a call, he or she causes the communication unit to transmit a first channel request signal (which includes the unit's identification number) requesting a communication channel. The first channel request signal has a power level that is a predetermined fraction of the maximum output power of the communication unit 10. The fraction of the maximum transmit power is selected in accordance with a preferred minimum distance from the base site granting the communication channel (to establish the sought communication link). The preferred minimum distance from the base site is represented by area 18. In this example, only base site 12 is within the area 18, thus only base site 12 receives the first channel request signal. Therefore, base site 12 (rather than base site 14) grants the communication unit 10 the communication channel, thus solving the problem that would have been caused by the more distant base site 14 granting the communication channel. Once the communication link is established, the communication unit 10 operates at its maximum transmit power.

Referring to Figure 2, a radio telephone handset 20, in accordance with the invention, is shown in block diagram form. The handset 20 comprises a receiver 22, a received signal strength indicator (RSSI) 32, a controller 24 (e.g., a conventional microprocessor), a transmitter section 26, and a power radio-frequency amplifier 28, and a power level control circuit 30 (e.g., a

feedback circuit with adjustable resistance) for adjusting the gain or output power level of the RF amplifier 28. The RSSI detector 32 is used to determine the received signal strength (RSS) level of signals received (e.g., from a base site). A conventional microphone 40 and audio amplifier 42 receive voice signals and provide representative audio signals to the transmitter 26. A channel request switch 38 is coupled to the controller 24 so that the transmission of signal request signals is initiated when the switch 38 is activated. This switch 38 may be mechanically activated by, for example, opening a flap in the handset 20. A speaker 44 provides sound signals to the user.

Referring to FIG. 3, there is shown a flow chart of a channel acquisition method for use in a CT2 communication system, in accordance with the invention. In step 100, a radio telephone handset (e.g., handset 10) has its output power level set to power level 1. Power level 1 is preferably very low (e.g., 0.16 miliwatts, or -18 dB from the normal output power) to attempt establishing a communication link with the closest base site. In step 102, the handset 10 looks for a base site by transmitting a first communication channel request at the first power level. In decision, 104 a determination is made as to whether a communication link has been granted. If a communication link has been granted, then a decision 106 is made to determine whether the transmit power is at the normal operating level. If the transmit power is not at the normal level, it is increased to the normal level in step 108. Then in step 110, operation continues in accordance the protocol set forth in the Document of Common Air Interface MPT 1375 (Department of Trade and Industry).

If it were determined in decision 104 that a communication link has not been granted, a further decision 112 is made to determine whether the present power level is normal. If it is normal, the user is given a "no link" indication in step 114. If the power level is not normal, the transmit power level is increased in step 116, and the process returns to step 102.

In this embodiment, there could be made a predetermined number of attempts to establish a communication link, each attempt using an incremented transmit power level. For example, a second attempt could be at 0.63 miliwatts ERP (-12 dB from normal), a third attempt at 2.50 miliwatts ERP (-6 dB from normal), and a fourth attempt at 10.00 miliwatts ERP (which is normal under the CAI). An advantage of this approach is that under the CT2 protocol, the handset will not switch channels after 750 miliseconds.

Referring to FIG. 4 there is shown a flow chart of another channel acquisition method in accordance with the invention. In certain circumstances, the first channel grant, responsive to a channel request signal may not be the best base site to establish a communication link with the handset requesting the link. For example, there may have been a temporary obstruction blocking the best base site from the handset as it transmitted its channel request signal. Thus, it may be desirable not to accept the first channel grant received. In step 200, the transmit power of the radio telephone handset is set to level 1. In step 202 the radio telephone handset transmits a first channel request signal at level 1 (which is a fraction of the available maximum or normal transmit power). In decision 204 the radio telephone handset determines whether a channel grant signal is received from a base station. This channel grant signal may also be also any other signal that may be used to determine RSS of signals transmitted by a particular base site.

If a channel grant signal has been received, the handset measures and stores the received signal strength level (the RSS level) of the received channel grant signal in step 206 . Then, in step 208 the transmit power is set at level 2 which is higher than level 1, and a second channel grant signal is transmitted.

In step 212, a second decision is made to determine whether any channel grant signals have been received in response to the second channel request signal. If a channel

grant has been received, the handset measures and stores (step 214) the RSS of the received channel grant signal(s). Then in step 216 the handset compares the RSS level of each received channel grant signal with the levels of any other channel grant signals that have been received (and stored).

In decision 218, the handset determines whether a base site can be selected on the basis of RSS and transmit power level. Some situations may be ambiguous, thus resulting in a "No" answer. For example, if the RSS level of the second channel grant signal is higher than that of the first channel grant signal there is no clear best site, thus a third comparison must be made. Accordingly, if the answer in decision 218 is "No," the transmit power level is increased to a third level 3, in step 222. Then a third channel request signal is transmitted in step 224.

A third decision 226 is then made to determine whether any channel grant signals have been received in response to the third channel request signal. If none are received, the power level may be increase N times and the process may continue in step 230, or the process may be stopped at this point. If a channel grant or grants are received in response to the third channel request, the process continues to step 214. At this point there should be sufficient information to make a decision (218) on the best base site.

If the first and second channel request signals do not result in reception of a channel grant signal, and a channel grant signal is received in response to the third channel request, then the third channel grant would be accepted, thus establishing a link.

In step 220 the handset determines and chooses the base site having the highest RSS at the lowest transmit power level, thus establishing a communication link.

This method of selecting a base station substantially increases the probability that the nearest base grants the communication link.

What is claimed is:

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Claims

1. In a communication system having a plurality of base sites capable of allocating a communication channel for use by a 10 communication unit in response to a channel request signals from the communication unit, a method facilitating the use of a particular base site comprising the communication unit steps of:

transmitting a series of channel request signals, each successive channel request signal having a greater power level 15 than the preceding channel request signal, until a channel grant is received or a predetermined number of channel request signals is made.

2. In a communication system having a plurality of base sites capable of allocating a communication channel for use by a communication unit in response to a channel request signals from the communication unit, a method facilitating the use of a particular base site comprising the communication unit steps of:

(a) transmitting a first channel request signal at a first power level;

(b) transmitting a second channel request signal after a time period, if a communication channel grant is not received, the second channel request signal having a power level greater than the power level of the first channel request signal.

3. The method of claim 2, further comprising the communication unit steps of:

(c) receiving a channel grant signal;

(d) operating in a normal communication mode whereby signals are transmitted at a predetermined power level.

4. The method of claim 2 wherein the predetermined power level is the power level of the second second channel request signal.

5. The method of claim 2, further comprising the communication unit steps of:

(c) transmitting a series of channel request signals, each successive channel request signal having a greater power level than the preceding channel request signal, until a channel grant is received or a predetermined number of channel request signals is made.

6. The method of claim 5, further comprising the communication unit steps of:

(e) receiving a channel grant signal;

(f) operating in a normal communication mode whereby signals are transmitted at a predetermined power level.

7. In a communication system having a plurality of base sites capable of allocating a communication channel for use by a communication unit in response to a channel request signals from the communication unit, a method facilitating the use of a particular base site comprising the communication unit steps of:

(a) setting a first transmit power level for the communication unit;

(b) transmitting a first channel request signal;

(c) determining whether a channel grant signal is received;

(d) determining whether the first transmit power level is equal to a predetermined level; and

(e) setting a second transmit power level for the communication unit, when a channel grant signal is not received and the first transmit power level is not equal to the predetermined level, the second power level being greater than the first transmit power level.

8. A communication unit comprising:

transmitter means;

means for causing the transmitter means to transmit channel request signals having a variable power level;

means for receiving channel grant signals; and

means for increasing the variable power level, responsive to the means for receiving channel grant signals.

9. In a communication system having a plurality of base sites capable of allocating a communication channel for use by a communication unit in response to a channel request signals from the communication unit, a method facilitating the use of a particular base site comprising the communication unit steps of:

(a) transmitting a first channel request signal at a first power level;

(b) receiving a first channel grant signal from a base station;

(c) measuring and storing the first signal strength level of the first channel grant signal;

(d) transmitting a second channel request signal at a second power level that is greater than the first power level;

(e) receiving a second channel grant;

(f) measuring and storing the received signal strength level of the second channel grant signal; and

(g) comparing the received signal strength level of the first channel grant with the received signal strength level of the second channel grant signal to determine which channel grant signal has a greater received signal strength level; and

(h) selecting a base site based on the stored received signal strength levels, and on their corresponding transmit power levels.

FIG.1

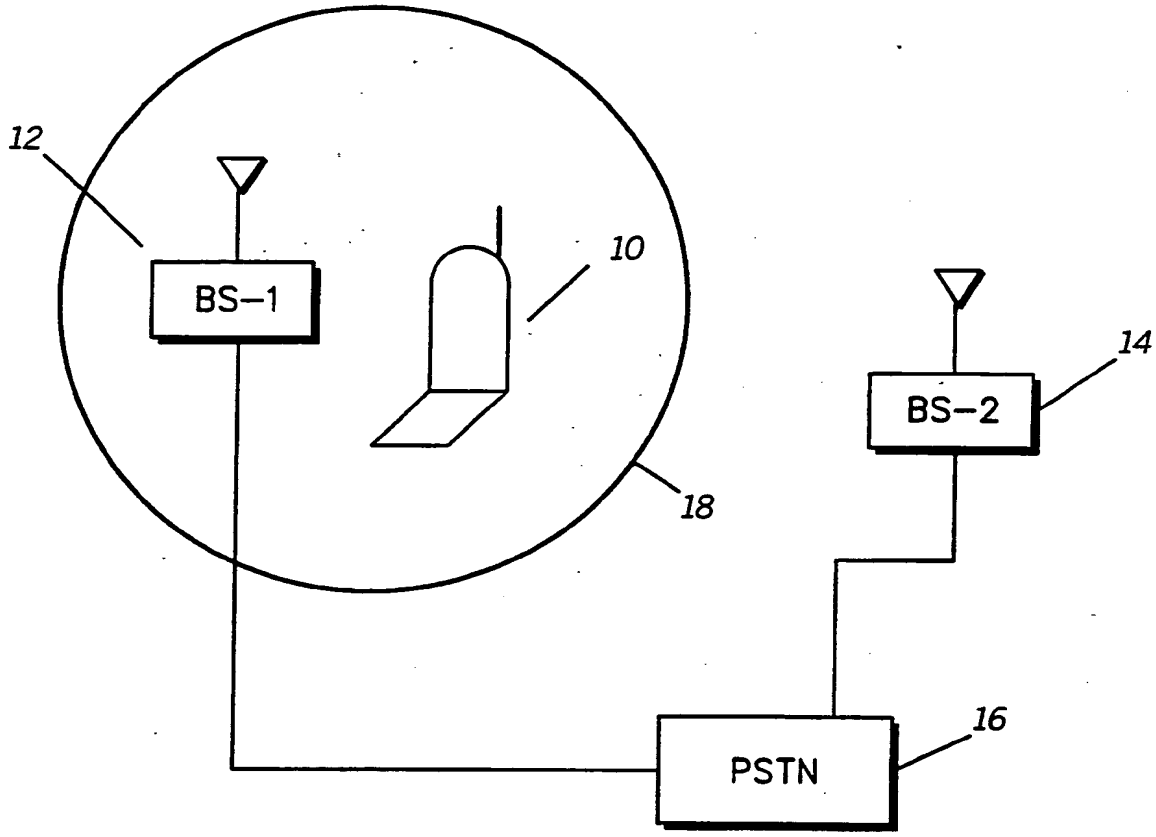
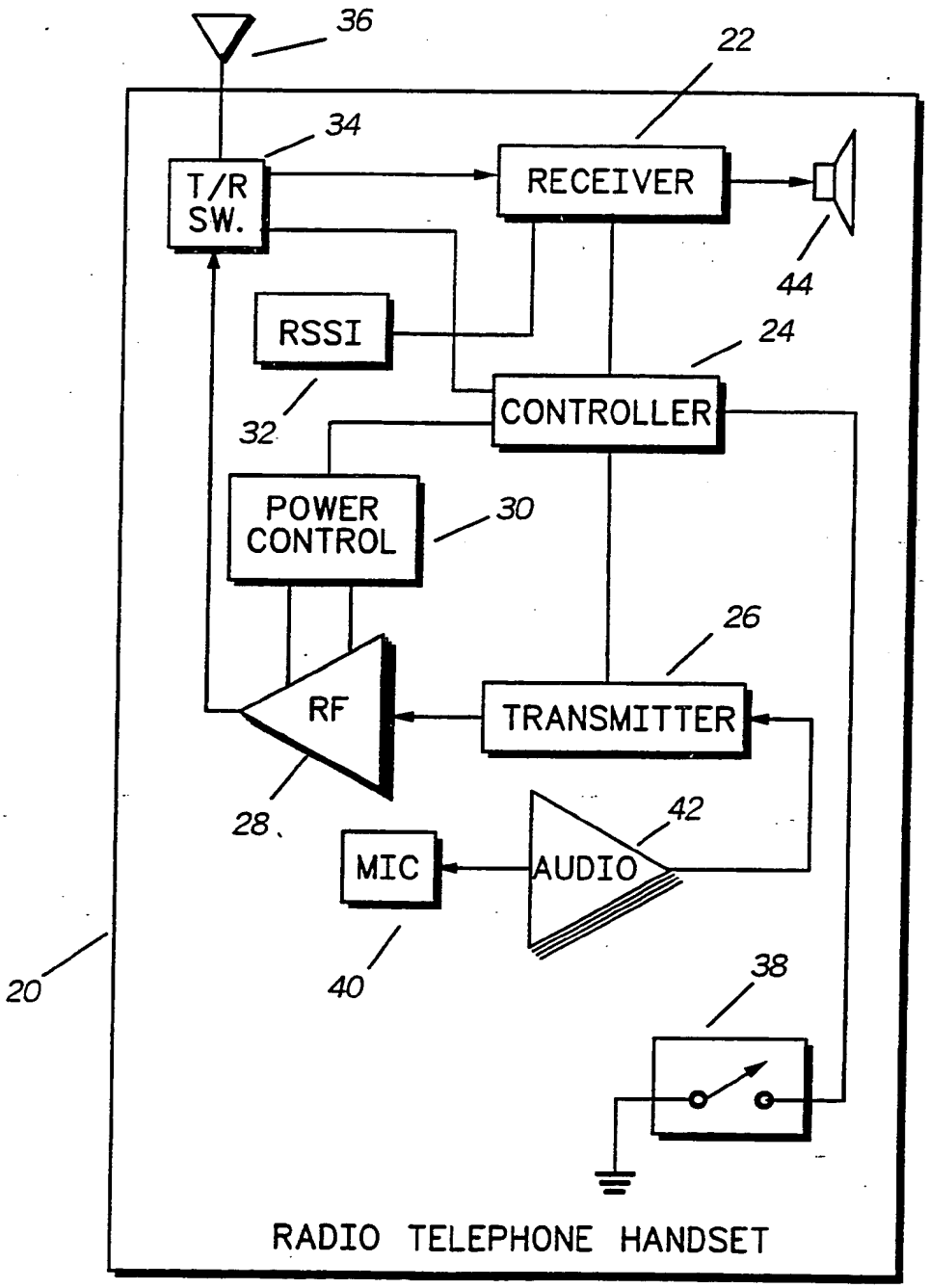


FIG.2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CONTROLLER
POWER CONTROL
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TRANSMITTER
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42
MIC
AUDIO
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38
RADIO TELEPHONE HANDSET

FIG. 3

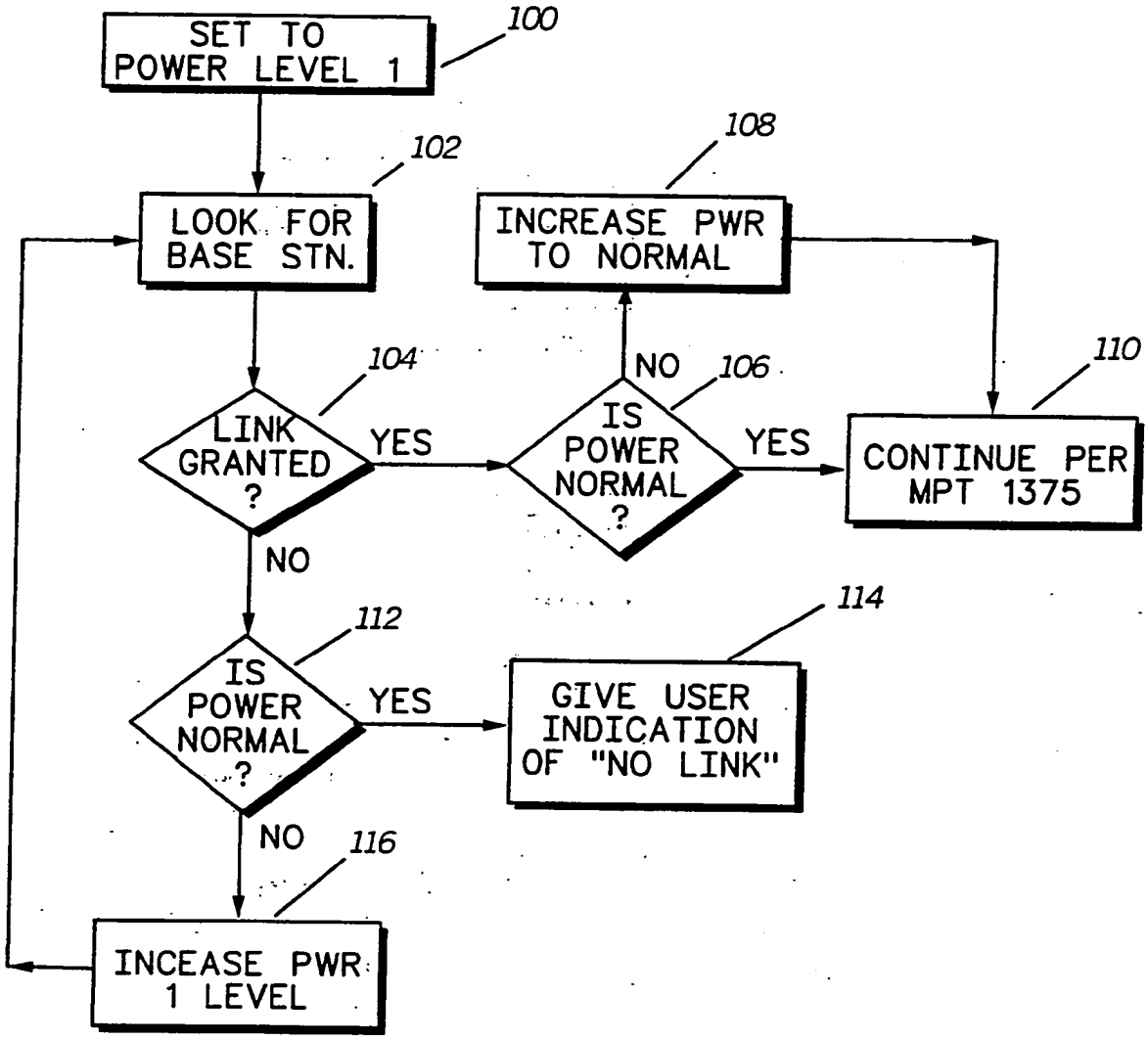
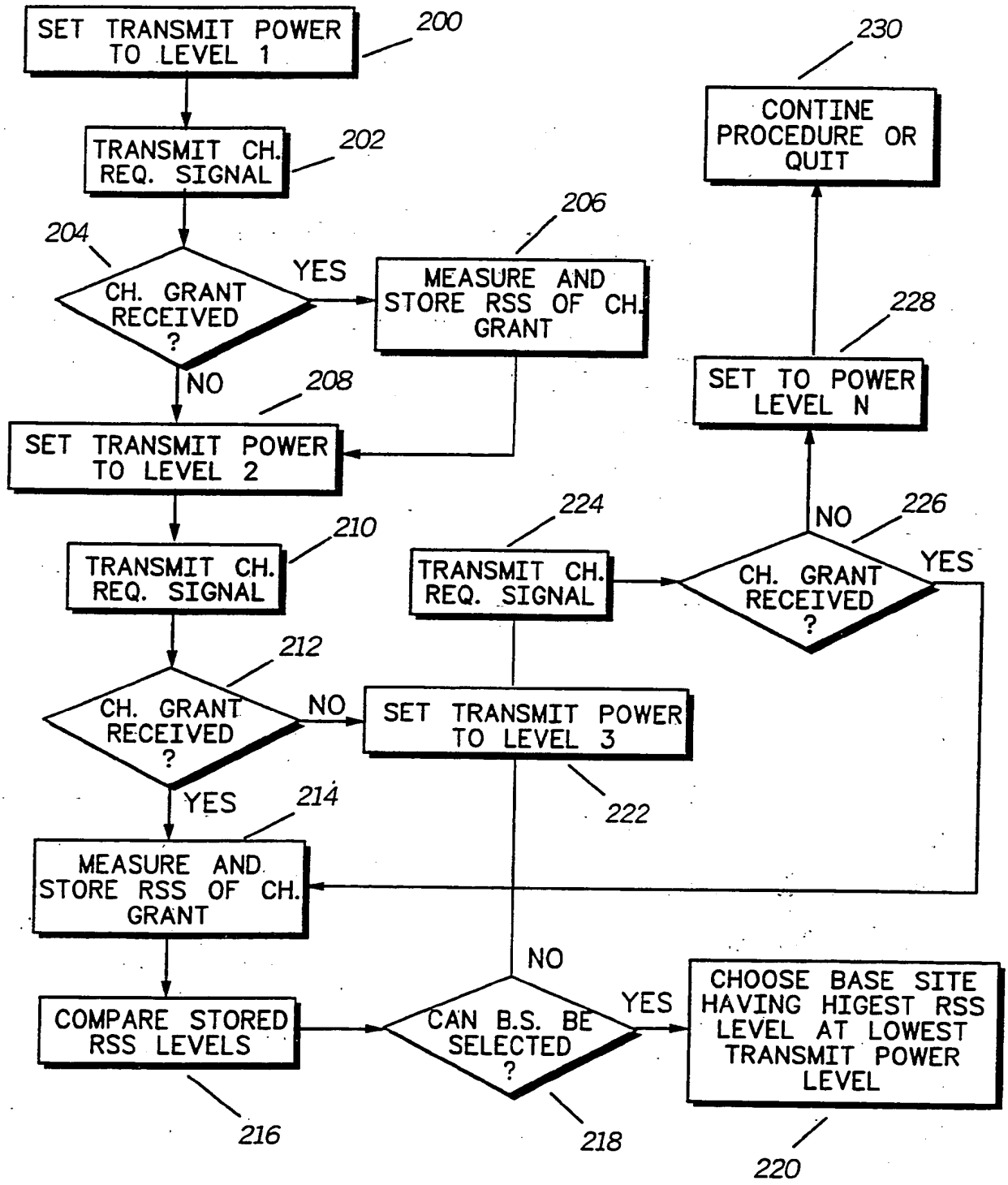


FIG.4



INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/04720

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :H04B 1/04
US CL :455/127,38.3
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 455/33.1,33.2,54.2,56.138.3,126 ,455/127,38.3

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS signal(s), power, increasing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 3,986,119 (HEMMER, JR. ET AL.) 12 October 1976, See entire document.	1-9
Y	US, A, 4,984,290 (LEVINE AT AL.) 08 January 1991, See entire document.	1-9
Y	US, A, 5,010,583 (PARKEN) 23 April 1991, See entire document.	1-9

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